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(54) Abstract Title
Optical transceiver with concentric reflector

(57) In an assembly (1) for directed, bidirectional, optical data transmission wherein an emitter chip (10) for the transmission of IR rays, a detector chip (8) for the reception of IR rays and an optical system (2) with an optical axis for focusing the transmitted and received rays are arranged as components in a one-part or multi-part housing (3, 18), a reflector is arranged concentrically to the optical axis and surrounding the components (8, 10) and the optical system (2) such that the transmission power and reception sensitivity of the assembly are increased.

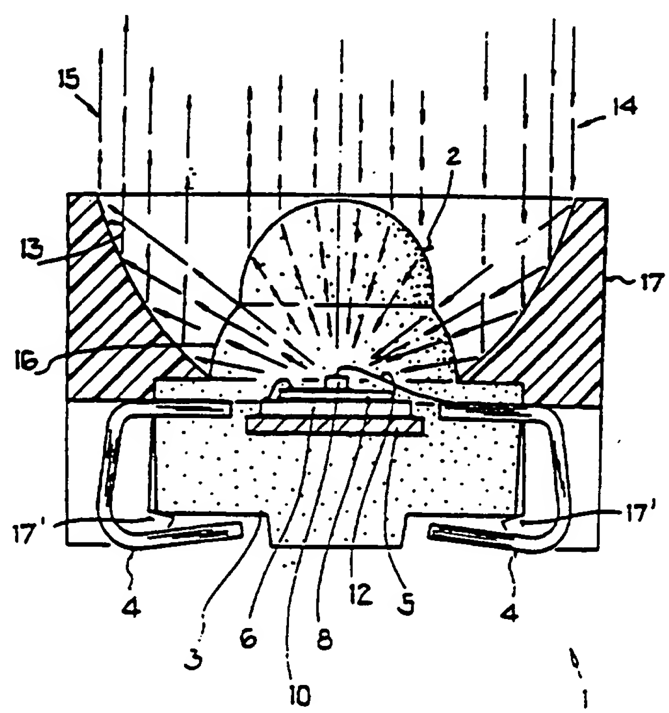

FIG.1

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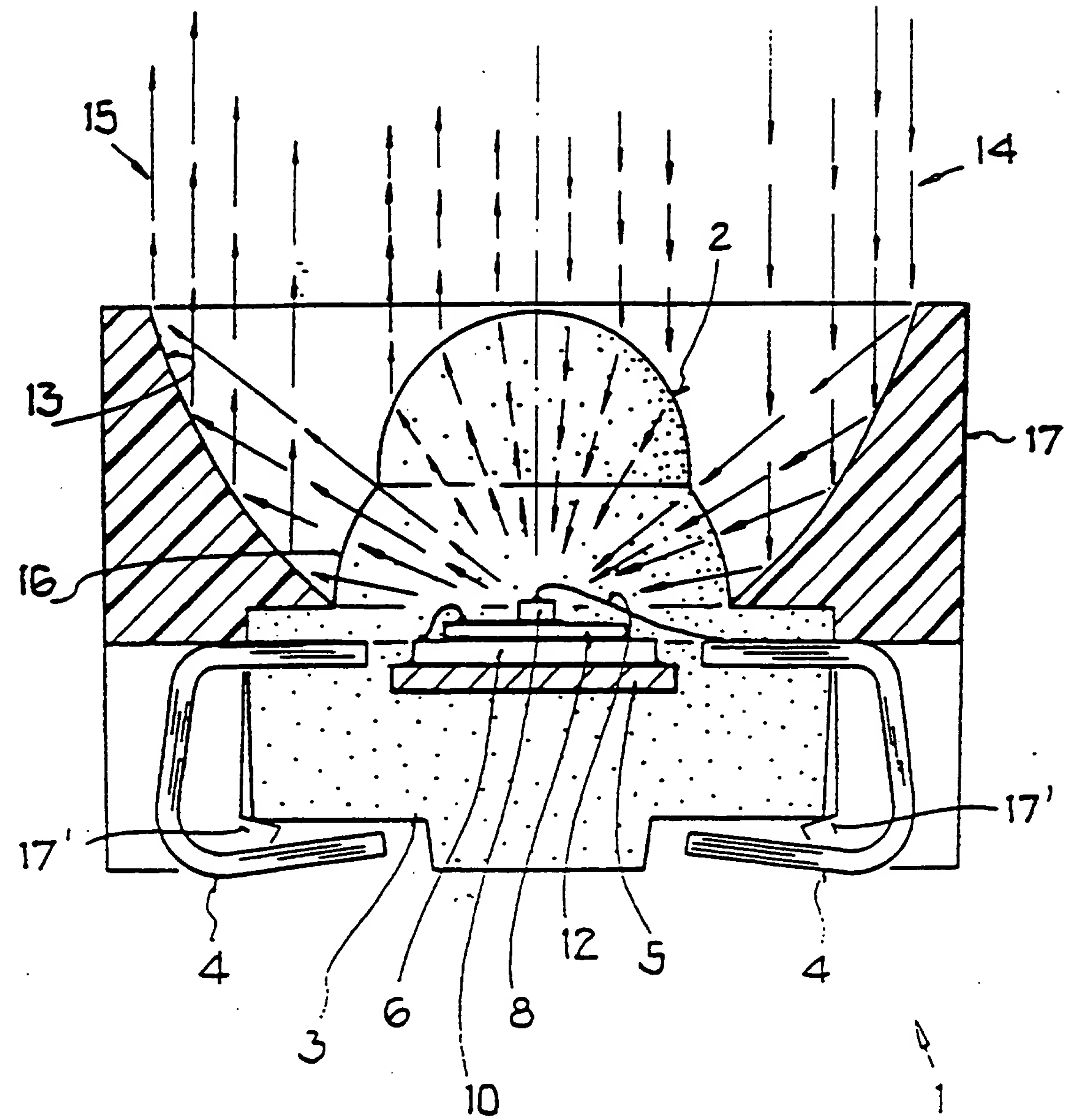


FIG.1

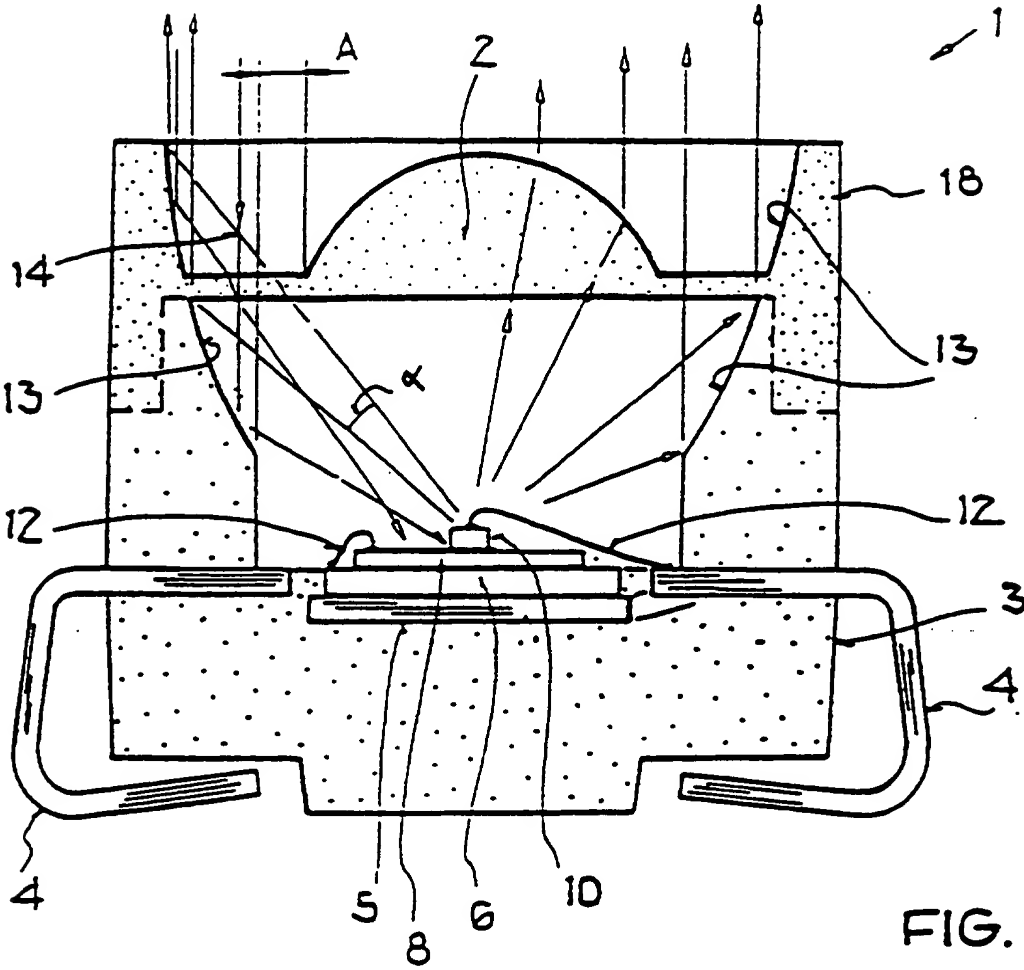
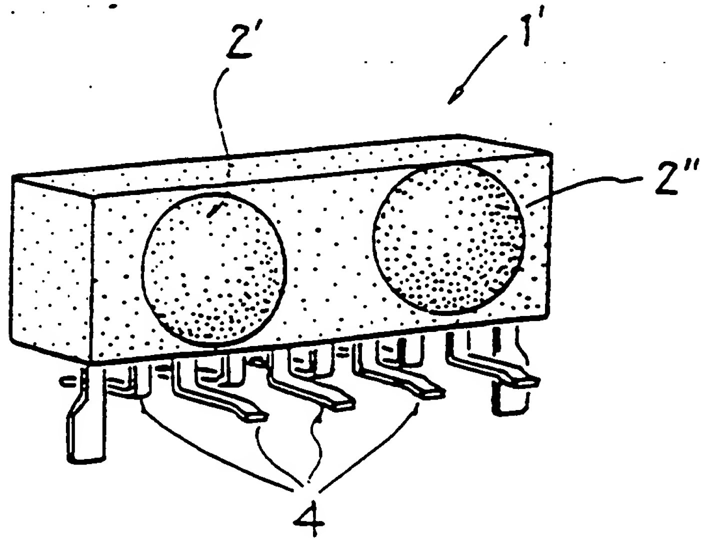


FIG. 2



State of the Art

FIG. 3

An Assembly for Data Transmission

The invention relates to an assembly for directed, bidirectional, optical or electromagnetic data transmission.

Such an arrangement, also known as transceiver (consisting of transmitter and receiver), is used for data transmission for IrDA applications. The IrDA (Infrared Data Association) standard was developed for data transmission by means of an optical point-to-point transmission link. For example, integrated transceiver assemblies complying with the IrDA standard are obtainable under the designation TFDS 3000 and TFDS 6000 from the company TEMIC TELEFUNKEN microelectronic GmbH.

In accordance with the prior art, an infrared transmitter (emitter), an infrared receiver (detector) and an integrated circuit for signal conditioning are arranged in a common housing of a transceiver. One surface side of the transceiver assembly comprises two juxtaposed, lens-like formations, at the focal point of which the transmitter and receiver are in each case arranged. These optical systems are necessary in order to achieve the directed signal emission from the transmitter and the directed sensitivity of the receiver required by the IrDA standard.

Such transceivers have the disadvantage that, due to the juxtaposition of transmitter and receiver, a separate optical system is in each case necessary in order to achieve the required directed signal emission from the transmitter and the directed sensitivity of the receiver. This gives rise to high material costs and the dimensions of the transceiver assembly become relatively large.

If integrated circuit, receiver and transmitter are arranged above one another, and specifically the receiver is arranged on the integrated circuit and the transmitter is arranged on the receiver, the disadvantage occurs that a part of the receiver element is covered by the transmitter element and consequently the sensitivity is reduced. This manner of arranging the circuit, receiver and transmitter also means that it is not possible, such as for example in the case of LEDs, to arrange the transmitter in a cup-like reflector, leading to a drop in transmission power on account of the undirected emission.

The present invention seeks to provide an assembly which, in spite of smaller dimensions, has a high sensitivity and a high transmission power.

According to the present invention, there is provided an assembly for directed, bidirectional, optical data transmission, wherein an emitter chip for the transmission of IR rays, a detector chip for the reception of IR rays, and an optical system with an optical axis for focusing the transmitted and received rays are arranged as components in

a one-part or multi-part housing wherein a reflector is arranged concentrically to the optical axis and surrounding the components and the optical system such that the transmission power and reception sensitivity of the assembly are increased.

The advantages of the invention consist in that it is still possible to use a common optical system for a transceiver, whereby the dimensions of the assembly are substantially reduced and material costs are saved. The additional reflector serves to increase the transmission power and sensitivity of the transceiver in that laterally impinging IR rays are also picked up and fed to the receiver and in that IR rays which emanate laterally from the transmitter and pass by the optical system are also emitted.

Two exemplary embodiments of the invention are explained in detail in the following and illustrated in the Figures in which:

Figure 1 shows a transceiver with separate reflector in a sectioned view;
Figure 2 shows a transceiver with integrated reflector in a sectioned view;
Figure 3 shows a transceiver according to the prior art in a perspective view.

Figures 1 and 2 illustrate a transceiver 1 with a lens 2 as optical system, a housing 3 consisting for example of thermoplastic or thermosetting casting compound transparent

to IR rays, and terminal legs 4 extending outwards as part of a metallic strip carrier 5. An integrated circuit 6 serving for the amplification of the signals is secured on the carrier 5. Arranged on the integrated circuit 6 as receiver- or detector chip 8 is a photo-PIN-diode, which is a special IrDA product although it is produced using a technology commonly employed for photo-PIN-diodes.

A transmitter- or emitter chip 10 fundamentally comprising a known infrared transmitting diode is adhesively applied in concentric fashion to the detector chip 9. The surface of the integrated circuit 6 is larger than the surface of the detector chip 8, the surface of which in turn is larger than that of the emitter chip 10. The signal transmission between emitter chip 10 and integrated circuit 6 and between detector chip 8 and integrated circuit 6 takes place in known manner via bonding wires 12 composed of gold, aluminium or a highly conductive alloy.

Polyimide adhesive, solder, plastics solder or another common plastics adhesive is used for example to secure the integrated circuit 6 on the carrier 5, the detector chip 8 on the integrated circuit 6, and the emitter chip 10 on the detector chip 8. To ensure that the emitter chip 10 is conductively secured upon the detector chip 8, different adhesives or solders can in each case be used for the individual fixings. The connection between the integrated circuit 6 and the detector chip 8 can be conductive or non-conductive, although preference is to be given to the non-conductive connection.

Figure 1 illustrates a transceiver 1 with a separate reflector housing 17, where the shape of the reflector 13 corresponds to that of a partial paraboloid with a focal- or collecting point. For this purpose a recess of corresponding paraboloid formation is introduced into a rotation-symmetrical, thermoplastic or thermosetting reflector housing 17. For assembly, the reflector housing 17 is simply inverted over the housing 3 of the transceiver 1. Retaining lugs 17' ensure that reflector housing 17 and transceiver housing 3 are held together.

The optical system 2, which comprises a spherical zone 16 and in the simplest example consists of a plastics lens, and the reflector 13 are formed and mutually adapted such that both radiation emanating from the emitter chip 10 is optimally emitted and also incident radiation is optimally directed towards the detector chip 8. This is facilitated in that detector chip 8 and emitter chip 10 are not arranged one beside another as previously, but are arranged one above another. As a result, compared to the prior art in which a separate optical system must in each case be used for emitter and detector, it is possible to omit one optical system and approximately halve the width of the transceiver 1.

The reflector 13 is arranged around the components 6, 8, 10 and the lens 2 such that detector chip 8 and emitter chip 10 are situated at its focal- or collecting point. The reflector provides on the one hand that IR rays 14 impinging

outside of the lens 2 are also deflected to the detector chip 8 and on the other hand that IR rays 15, which emanate from the emitter chip 10 and pass the lens 2 on the right and the left, are emitted. As a result, a noticeable increase is achieved both in the sensitivity of the transceiver 1 and in its transmission power.

By way of a further exemplary embodiment, Figure 2 shows a transceiver 1 in the case of which an optical component 18 comprising reflector 13 and lens 2 is applied to the housing 3. The reflector 13, the shape of which corresponds to that of a partial paraboloid with focal- or collecting point, continues into the housing 3, for which purpose a likewise paraboloid recess is introduced into the housing 3. The reflector 13 is arranged around the components 6, 8, 10 and the lens 2 such that detector chip 8 and emitter chip 10 are situated at its focal- or collecting point. The remainder of the construction of the transceiver 1, in particular the arrangement of integrated circuit 6, detector chip 8, emitter chip 10 and lens 2, is unchanged compared to the arrangement shown in Figure 1.

The reflector 13 provides on the one hand that IR rays 14 impinging outside of the lens 2 are also deflected onto the detector chip 8 and on the other hand that IR rays 15, which emanate from the emitter chip 10 and pass by the lens 2 on the right and the left, are emitted. In this way a noticeable improvement is achieved both in the sensitivity of the transceiver 1 and in its transmission power.

Since, for production technology reasons, a space A occurs between the lens 2 and the reflector 13, a minimum solid angle α remains as so-called "dead solid angle" in the region of which the reception and transmission of IR rays is not possible. To minimise this solid angle α, it is necessary to attain the smallest possible space A since the size of the space A determines the size of the solid angle α.

Figure 3 shows a transceiver 1' according to the prior art. As the detector chip (not visible) and the emitter chip (likewise not visible) are arranged one beside another, a separate lens 2', 2" is in each case required for the emitter chip and the detector chip. For this reason, and because the terminals 4 of detector and emitter lead out separately, the transceiver 1' has approximately double the width of the arrangement according to the invention.

Claims

1. An assembly for directed, bidirectional, optical data transmission, wherein an emitter chip for the transmission of IR rays, a detector chip for the reception of IR rays, and an optical system with an optical axis for focusing the transmitted and received rays are arranged as components in a one-part or multi-part housing, wherein a reflector is arranged concentrically to the optical axis and surrounding the components and the optical system such that the transmission power and reception sensitivity of the assembly are increased.

2. An assembly according to Claim 1, when the reflector has the form of a paraboloid.

3. An assembly according to Claim 1 or 2, wherein the reflector is formed by a paraboloid recess introduced into the housing and into an optical component.

4. An assembly according to any of Claims 1 to 3, wherein the emitter chip and the detector chip are arranged at the focal- or collecting point of the reflector.

5. An assembly according to any of Claims 1 to 4, wherein the reflector consists of a thermoplastic or thermosetting casting compound transparent to IR rays.

6. An assembly according to any of Claims 1 to 5, wherein the reflective surface of the reflector (13) is metallized by vapour deposition.

7. An assembly substantially as herein described with reference to Fig 1 or Fig 2 of the accompanying drawings.

Patent Office

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Claims searched: 1-7

Examiner: Stephen Brown
Date of search: 28 August 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4B (BK2, BK4, BK6, BK12J, BK14, BK14C, BK14C2, BK14C2D, BK14D, BK14D2, BK14D2B, BK14D2C, BK24, BK24S).

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Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 1 466 486	(Corning) see whole document	1-3 & 6
Y	EP 0 471 565 A2	(Sony) See especially figure 19.	1-4
Y	US 4 279 465	(Singer) See whole document.	1-4

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